

APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

MULTI-ACTIVITY OFFSHORE DRILLING FACILITY HAVING A SUPPORT FOR A TUBULAR STRING

BY:

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MULTI-ACTIVITY OFFSHORE DRILLING FACILITY HAVING A SUPPORT FOR A TUBULAR STRING

TECHNICAL FIELD OF THE INVENTION

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The present invention relates to a method and device for decreasing the working time necessary for floating offshore drilling for petroleum products and for increasing the safety of the work. The invention further relates to a support cart, from which can be hung a long string of tubulars, and a method of using the support cart to allow installation of the set of production valves known as a Xmas tree without the need to completely pull the blow-out preventor (BOP) out of the water.

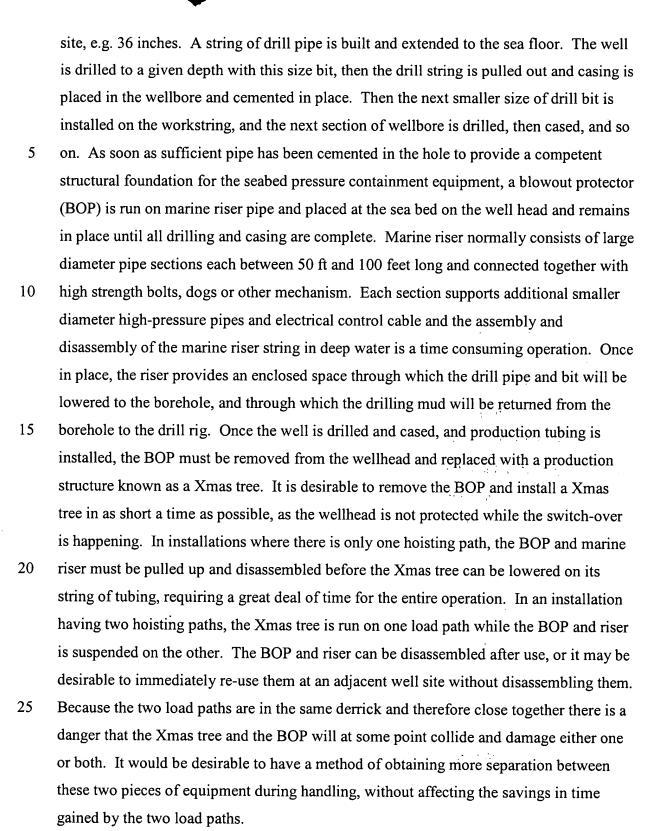
BACKGROUND TO THE INVENTION

Locating oil in deep water requires the use of large and expensive drilling rigs. These rigs can be drill ships, barges, tension leg platforms (TLPs), spars, or semi-submersibles. In each case, the investment is substantial. However, the need to find additional reservoirs of oil and natural gas is creating a need for a deep-water rig that can efficiently explore, drill and develop wells in ever deeper water, with current technology moving to achieve production at 7500 feet or greater.

The cost of developing a well is more than simply the cost of the rig. Every day of rig operation can cost in the hundreds of thousands of dollars. Therefore, it is important that operations run as smoothly, quickly, and safely as possible. One direction of development in offshore drilling is in multi-tasking jobs, that is, rather than performing the drilling and casing as one long set of sequential steps, some steps are effectively moved "offline", where they can be handled in parallel with other steps. For example, U.S. Patent 6,056,071, which is hereby incorporated by reference, discloses an offshore drillship in which the single derrick has two top-drives (main and auxiliary) and two sets of equipment to handle tubulars (drill pipe, casing, etc.). While the main drive is handling a current step, the auxiliary drive can be preparing equipment for a subsequent step.

Once an offshore drilling rig is moored on the drill site, the general flow of operations is as follows: the drilling starts with the largest size drill bit to be used for this

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SUMMARY OF THE INVENTION

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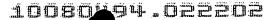
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This invention provides a means to suspend the BOP and riser string in such a manner that it can then be moved to the other end of the moon pool from the load path on which the Xmas tree is run. The horizontal separation provided by this maneuver is sufficient to reduce the risk of collision between BOP and Xmas tree to an acceptable level.

To suspend and move the string, a cart is provided which runs on rails located on both sides of the moonpool area. These rails are also used by the BOP elevator, which supports and stabilizes the blowout protector while it is being moved from storage to its underwater site. The cart is of heavy construction, with a rectangular base and wheels at each corner. A funnel-shaped opening runs through the cart, narrowing from top to bottom, while a roughly C-shaped opening in the front of the cart is wide enough to allow a marine riser or other tubular to be admitted within the opening. The cart can be moved on rails to the load path that is handling the BOP, so that the riser and BOP can be suspended from the cart. The cart, with the riser and BOP hanging from it, can then be moved to one side of the moonpool, where it will remain until it is required again by the operation. In one embodiment of the invention, the blowout protector (BOP) is disconnected from the well head, raised some distance above the seabed (e.g., 50 feet), and hung from the cart. After the cart is moved to the side of the rig opposite the hoist handling the Xmas tree, the Xmas tree assembly can be installed, without the need to completely pull the BOP and riser out of the water. Once the Xmas tree assembly is in place, the BOP can be pulled up or moved to an adjacent well head. This increases the safety of this exchange without slowing the path of critical operations.

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BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, wherein:

- Figures 1A and 1B are views of a semi-submersible drill rig from the side and front;
 - Figure 2 is a layout of the drill floor of the semi-submersible drill rig;
 - Figure 3 is a layout of the main level of the drill rig, showing an embodiment of the present invention;
- Figure 4 is a perspective of one embodiment of the cart of the present invention, which is used to hold a portion of riser or other tubular.

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DETAILED DESCRIPTION OF THE DRAWINGS

Figures 1A and 1B show side and front views of a semi-submersible drilling rig on which the disclosed invention can be utilized, although these views are greatly simplified for ease of understanding. With reference first to Figure 1A, the semi-submersible rig 100 has flotation elements 110, which provide buoyancy, and a working area 112, joined together by stability columns 114. The working area 112 is divided into different decks, but only two off these are of importance in this discussion and are shown. These are the drilling deck 120 and the main deck 122. In this view, the drilling derrick 124 rises from the drilling deck 120. Seen hanging from the primary load path below the main deck 122 are riser sections 132. Riser sections 132 can be stored horizontally in pipe racks or vertically; when stored vertically, as seen here the riser sections 132 extend vertically through the working area, with their lower portions seen below the decks.

Figure 1B shows a view of the semi submersible from the front of the rig. Large cranes 126 and 128 occupy sections of the main deck. Drilling derrick 124 is seen to have two hoist assemblies 140 for handling the various tubular structures (drill pipe, casing, risers, etc.) which are used in drilling and preparing a well for production. One hoist assembly, 140A, is designated the primary assembly, while the other, 140B, is the secondary assembly. Each of these hoist assemblies is associated with a system for rotating the drill pipe, either a top drive or a rotary table (not specifically shown). Having two hoists and two rotary assemblies allows a string of tubulars to be put together by the secondary hoist assembly 140B at the same time the primary hoist assembly 140A is handling other steps in the drilling process. This type of work sharing is further explained in U.S. Patent 6,047,781, which is hereby incorporated by reference. The primary and secondary hoist assemblies are located some distance apart, e.g. 30 feet, so that work on one does not interfere with work on the other. It is worth noting that at the ocean floor, which can currently be as much as a mile and a half below the water surface, the end of a work string will be guided into proper position by Remote Operated Vehicles (ROVs). In the water depths contemplated by this invention drill pipe is very flexible and a mile-long string of it will easily bridge the 30 or so foot separation between the two rotary assemblies without having to reposition the rig. As a result either the primary or

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secondary rotary assembly can be active in the borehole at any particular moment. Cart 150 is seen on the main deck of the rig, where it can traverse most of the width of the deck on its rails.

Turning now to **Figure 2**, a simplified layout of the drilling floor is shown. The derrick floor **202** is elevated above the rest of the drilling floor. Rotary tables **204** are positioned in the drill floor below the primary and secondary hoisting paths. On the drill floor, drill pipe and the drill bit is made up and run through the water column to the sea bed where it is rotated by either the rotary table or a rotating mechanism (top drive) suspended in the derrick. Later, casing tubulars are assembled in one of the hoisting paths and run into the hole. Ramps **210A** and **210B** feed pipes to the primary and secondary hoisting paths respectively. In this embodiment risers **206** are stored vertically here and extend through the deck to the level below although the riser can also be stored horizontally.

Figure 3 shows a schematic of the layout of the main deck level. Central to this level is the moonpool 310, an open area through which the tubulars are extended from the drilling floor to the seabed. The cranes 314 have their bases on opposite sides of the main deck, with booms of sufficient length to reach most areas. Other features seen on this level include portions of crew living quarters 320, mooring assemblies 340, riser storage area 390, pipe storage areas 330, and storage areas 360 for the blow-out protector (BOP) and Xmas tree assemblies. Rails 380 run on either side of the moonpool 310. These rails 310 are used to carry the BOP elevator 370, which is used to transport the BOP from its storage position to a position under the primary load path where it can be connected to the marine riser. The rails are also used to carry the innovative support cart 350.

Figure 4 shows a preferred embodiment of the support cart 350. In this preferred embodiment, the cart is rectangular in shape, with two wheels 410 on each of the two shorter sides. The width of the cart is such that the cart straddles the moonpool, with its wheels 410 riding on the rails 380 on either side of the moonpool. In the center of the cart, a truncated funnel-shaped hole 420 extends through the cart. One side of the cart features a C-shaped slot 425, sized to allow the insertion and removal of a section of marine riser.

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The support cart 350 can be used near the end of the development of the well, when it is time for the BOP to be pulled and replaced by a Xmas tree assembly. Rather than pulling the BOP completely out of the water or leaving it in relatively close proximity to the Xmas tree assembly, the BOP, attached to its string of marine riser pipe, is pulled out of the hole a short distance (e.g., 50 feet), so that it can clear the seabed as it is moved. Then the entire assembly of marine riser, with BOP at the end, is hung on the support cart, which receives the entire weight of the string. In the presently preferred embodiment, cart 350 has a static capacity of 700 metric tons. The cart will then be moved to a position at the end of the moonpool, distant from the Xmas tree assembly that is being installed. This lateral movement reduces the risk of a collision between the BOP and the Xmas tree to an acceptable level. The riser and BOP will remain at this location until the operation requires the BOP to be installed on an adjacent well head or for the BOP to be retrieved to the rig.

Thus, the innovative cart increases safety on the rig, decreases the likelihood of damage to expensive equipment machinery, and allows time consuming operations such as retrieving the BOP and riser to be performed offline.

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